

Application S/N 10/678,489
Amendment dated: May 25, 2005
Response to Office Action dated: March 15, 2005

CE11821JME

REMARKS/ARGUMENTS

Claims 1-20 are pending in the application. In the Office Action, claims 7, 8 and 15-19 were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,346,118 to Degani, et al. (Degani). In addition, claims 7-10, 12 and 14-17 were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,150,717 to Wood, et al. (Wood). Please note that Applicants believe that claims 7-10, 12 and 14-17 were rejected in view of Wood, even though the first sentence in paragraph 2 on page 3 lists a different set (see the Examiner's following comments). Finally, claims 7 and 20 were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,539,153 to Schwiebert, et al. (Schwiebert).

A brief summary of the Degani, Wood and Schwiebert references may be helpful here. Degani discloses a process for soldering a component having solder bumps to a substrate. In particular, in FIG. 4, Degani shows an assembly with solder bumps 12 on an IC package 10 and solder bumps 17 formed on a board 11. A similar construction is shown in FIG. 5 in which solder paste deposits 18 are formed over terminal pads 14 on the board 11. Degani does not describe the placement of solder of different compositions in different areas between the IC package 10 and the board 11. In addition, the inventive process described in Degani addresses the issue of establishing a reliable solder joint while at the same time avoiding shorts between adjacent solder joints. Degani never discusses the issue of different coefficients of thermal expansion (CTE) between various substrates.

Wood is directed to a semiconductor package and a method for fabricating the package. As shown in FIGs. 11-11E, bumped electrodes 96 and solder bumps 12M can be formed of various alloys. In particular, the solder bumps 12M are formed of a

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high-temperature solder alloy, and the bumped electrodes are comprised of a low-temperature solder alloy. The temperature of a reflow process is maintained at a temperature between the different melting temperatures of these solder alloys. As a result, the bumped electrodes liquefy and form a bonded connection with the solder bumps. The solder bumps, however, maintain their structural rigidity during the reflow process, which prevents collapse of the die 10M onto the supporting substrate. Wood does not address the issue of mismatching CTEs; the process described above is only concerned with preventing a component from collapsing onto a board.

Schwiebert discloses a method of bumping substrates by contained paste deposition. As depicted in FIGs. 6A-6C, stand-off bumps 610 and metal bumps for interconnection 612 are formed on a substrate. During reflow, the stand-off bumps 610 will not melt and collapse, i.e., they will maintain their structural rigidity, and the metal bumps for interconnection 612 will liquefy. The final product is shown in FIG. 6C. Here, the stand-off bumps 610 are provided merely to set and control the height between two substrates.

Independent claim 7 has been amended to clarify that solder of a first composition can reside in a first area between substrates and solder of a second composition can reside in an area that is separate from the first area in which the first solder and the second solder are in a collapsed state. Support for the amendment can be found in FIG. 4 and in paragraph 18 on page 6. In direct contrast, neither Degani nor Wood describe or even suggest an assembly having solder of a first composition in a first area and solder of a second composition in an area different from the first area. Indeed, such a concept does not apply to these two references because neither is concerned with nor even mentions CTE mismatch between different substrates.

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Because CTE mismatch was addressed during its production, the final assembly in the present invention is more stable than prior art assemblies.

While Schwiebert does show solders of different compositions in different areas, one of the solders is a stand-off bump, which maintains its structural integrity throughout the reflow process and does not collapse. As a result, the stand-off bumps that reside between the two substrates are not in a collapsed state (see FIG. 6C). Conversely, the different solders in the present invention are in a collapsed state in the final assembly. Because they were allowed to liquefy during the reflow process, the final assembly produced by the collapsed solders of the present invention will be lower in height than in Schwiebert, which is important in view of certain electronic device becoming smaller and smaller. In addition, the collapsed solder of the present invention results in a final assembly that has a higher structural integrity than that in Schwiebert.

In view of the above, Applicants now believe that independent claim 7 is patentable over the prior art. Applicants also believe that those claims that depend from independent claim 7 are now patentable, in view of both their dependence from claim 7 and their independent patentability. Reconsideration and withdrawal of the rejection of the claims is respectfully requested. Passing of this case is now believed to be in order, and a Notice of Allowance is earnestly solicited.

No amendment made was related to the statutory requirements of patentability unless expressly stated herein. No amendment made was for the purpose of narrowing the scope of any claim, unless Applicant has argued herein that such amendment was made to distinguish over a particular reference or combination of references.

In the event that the Examiner deems the present application non-allowable, it is requested that the Examiner telephone the Applicant's attorney or agent at the number

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indicated below so that the prosecution of the present case may be advanced by the clarification of any continuing rejection.

The Commissioner is hereby authorized to charge any necessary fee, or credit any overpayment, to Motorola, Inc. Deposit Account No. 50-2117.

Respectfully submitted,

SEND CORRESPONDENCE TO:

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